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ABSTRACT

Persons quantifying classroom verbal interaction may obtain varying results as a consequence of using different media forms in their experiments. A study was done to see if the medium used in the codification process has an effect upon data obtained, and if so, what the nature of the effect is. Codification consists of the translation of observed behavior into analyzable data. Classroom verbal interaction is defined as the verbal behavior of students and teachers in the classroom. Four possible media for data collection about this behavior are direct observation, audiotape recordings, videotape recordings, and typescripts. The experiment showed that for certain verbal behaviors the medium used in the observation did exert a significant influence on the data obtained. However, these effects did not become more pronounced with increasing complexity in the system of behavioral categorization used. A major conclusion was that, with the exception of typescript, factors such as cost and ease of data collection should be given primary consideration in choosing a medium. (RB)

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THE EFFECT UPON VERBAL INTERACTION DATA OF THE MEDIUM EMPLOYED IN THE CODIFICATION PROCESS

by

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INTRODUCTION

Background

Persons quantifying classroom verbal interaction, if they are using differing media forms, may not obtain comparable data. This study was undertaken to determine if the medium employed in the codification process has an effect upon classroom verbal interaction data, and if so, what the nature of the effect is.

Although observation of phenomena is the cornerstone of the scientific method, it is only in recent years that systematic observation of classroom verbal interaction has become widespread (Rosenshine, 1970). This widespread use of systematic observation has led to the development of more than a hundred category systems (Simon and Boyer, 1970, Rosenshine, 1970) for investigating classroom interaction.

With this very rapid growth in the development and utilization of observational systems for research on teaching and training, certain methodological problems have arisen. Sjogren (1970) states that observer effects and reactive effects of instruments are two persistent methodological problems which demand immediate attention. These problems, and others, must be confronted if the validity of results reported in studies using observational systems are to be accepted. Medley and Mitzel (1963) asserted that there was no well organized theory or methodology for observing classroom behavior. Similarly, Stake (1970) decries the shortage of accepted procedures for making systematic observation of educational activities. There have been, however, several attempts to explicate a methodological approach to use in classroom observations. In their discussion on use of classroom observational systems Medley and Mitzel (1963) state there are "two phases in the process

of measuring classroom behavior: 1) Securing a record of a sample of the behaviors to be measured, and 2) quantification of the record [p. 293]." Closely paralleling this position, Biddle and Adams (1967) describe behavioral observation as a four step process: 1) Freezing the data, 2) Converting the data, 3) Analyzing the converted records and, 4) Interpreting the results. In the step they call "freezing the data," Biddle and Adams clearly have the same intent as do Medley and Mitzel when they speak of "securing a record of a sample of behaviors." The Biddle and Adams step of "converting the data" is parallel to the Medley and Mitzel phase of "quantification of the record." Both Medley and Mitzel and the Biddle and Adams references imply that the collection of the behavioral record and the quantification of the record are distinct steps in the classroom observation process. Biddle and Adams comment further that each of the four steps in the behavioral-observation process "should be carried on independently and to the greatest extent, should be mechanized [p. 116]."

In discussing current research efforts using observational category systems Biddle and Adams (1967) note that in the majority of cases the steps of collecting the bahavioral record and codifying the record are combined with a live observer performing both phases simultaneously. They assert that "this contamination of observational steps contributes to the overall unreliability of observational methods [p. 116]." This warning about contamination of observational steps echoes that by Medley and Mitzel (1963). While Medley and Mitzel simply state that the collection and codification of a record must be separated, Biddle and Adams go further to suggest ways in which this can be done. They propose that modern devices such as audio or video tapes be used in the collection of the behavioral record. They suggest that records made in this way are impartial, more detailed, and completely

reliable. The codification process can then be performed at the investigators leisure and the behavior sequences can be played back over and over until reliability of the codification process is assured.

In studies that use observational category systems much attention is given to the training of observers to a high degree of inter and intra-observer reliability. The most common approach to training observers is to have them initially code from audiotapes until they become familiar with the category system used and achieve satisfactory reliability. Generally they will undergo additional training under the actual conditions they would face in a proposed or existing study. This additional training seems to give recognition to the fact that attaining reliability under one medium is not enough to ensure reliability under another. Mitzel and Rabinowitz (1953) showed that observers could attain the same degree of reliability when observing live classrooms as they could through the use of audiotapes and typescripts.

Attention comparable to that afforded the reliability issue has not been given to the issue of the degree to which the medium used in the codification process affects the data that are generated through the codification process. This is perhaps due to the fact that within any one study the codification process is generally held constant. Therefore any bias introduced by the medium employed for coding would be the same across all groups being studied and could be ignored. This is not the case, however, when one tries to extrapolate information from several research studies in an attempt to compare or contrast their findings. The implicit assumption that "data are data" and therefore the medium employed in the codification process is unimportant could be dangerous.

The problem that is raised by making comparisons without considering

the above assumption is one of validity. Medley and Mitzel (1963) state "a measure is valid to the extent that differences in scores yielded by it reflect differences in behavior--not differences in impressions made on different observers." (p.250) Any bias in the data which is attributable to the medium employed in the codification process could affect the validity of the results and thereby obscure commonalities and differences in research findings.

It was the purpose of this study to investigate the assumption that the medium ~~test~~ would does not affect the coding process. The study should either provide empirical justification for this assumption, or sound a warning to those who make the assumption to interpret and generalize from their results with caution.

Discussion of Basic Concepts

Four concepts were identified and isolated in an attempt to determine whether the codification of classroom verbal interaction data is affected by the medium employed in the codification process.

Classroom Verbal Interaction

In this study classroom verbal interaction is defined as the verbal behavior that teachers and students use when interacting in a classroom. Observations of classrooms were conducted using two category systems:

1) Flanders' System of Interaction Analysis (Flanders, 1965), herein referred to as FSIA-10. (Appendix A)

2) Flanders' expanded system, a modification of the FSIA-10 through the use of subscription. This system (Flanders, 1966) will be referred to as FSIA-22. (Appendix B)

Medium

Medium, as used in this study, refers to the form in which the record

of a sample of classroom interaction is presented to the coder for quantification. The four forms to be considered in this study are live observation, audiotape recordings, videotape recordings, and typescripts.

Codification

Once an observer has determined the category system and medium he will use to observe classroom verbal interaction he is then in a position to codify the occuring behaviors. The codification process is the translation of the complex and rapidly shifting verbal interactions of a classroom situation into a quantified behavioral record which can be analyzed.

Complexity

For the purpose of the present study complexity refers to the number of categories which an observational system employs. Simon and Boyer (1968) state that "the use of a complex system requires a tape recording and/or typescript [p. 13]." Gage (1970) asserts that the advent of audio and videotape recordings in research on teaching has improved the feasibility of studying phenomena at all points on the complexity continuum.

It seems reasonable, therefore, to expect that if a media effect does exist, the medium employed in the codification process will become a more powerful factor as category distinctions become finer. The opportunity for playback and reanalysis of sequences of behavior may become much more important as an observational system becomes more complex.

PROCEDURE

The Sample

Data for this study were gathered in two large suburban school systems in central New York. All of the teachers in grades two through six from the two schools selected for use in this study were asked to participate. Of the teachers who were asked to participate in the study all but one volunteered. From these volunteers, sixteen teachers, eight from each school, were selected as participants. The teaching experience of the sixteen teachers ranged from two years to approximately twenty-five years.

The classes taught by the teachers used in this study included grades two through six. There were two second grade classes, three third grade, three fourth grade, three fifth grade and five sixth grade classes.

Research Design

The research design followed in this study was a 4 x 4 Latin Square with repeated measures (Winer, 1962). The primary independent variable was the four forms of media employed in the codification of classroom verbal interaction data. These four forms, Live observation (L), Audiotape recording (A), Videotape recording (V), and Typescript (T) were identified within the cells of the Latin Square. Two additional variables were isolated due to their possible influence on the data generated through the codification process. These variables were 1) the actual teachers observed, and 2) the individuals who coded the behavioral record. By utilizing the Latin Square design, the variation due to teachers and coders could be isolated while the effects of the media on the data generated during the codification process were evaluated.

Procedures for assignment of subjects and treatments as described by Kirk (1968) and Winer (1962) were used to yield the design employed in

this study. (Figure 1)

Coder #

Teacher Group #	1	2	3	4
1	L	A	V	T
2	A	V	T	L
3	V	T	L	A
4	T	L	A	V

Where: L - Live, A - Audiotape, V - Videotape, T - Typescript

Figure 1 -- Final 4 X 4 Latin Square Design

Creating the Setting

The teachers who volunteered to participate in the study were told precisely the purposes of the study. It was emphasized that their behavior, and that of their students, was not an issue in the study. All teachers were asked that for the period they were observed that they conduct a discussion lesson in their subject area.

Observations

Prior to making the actual observations for this study, eight coders underwent a three-week training period in the use of the interaction analysis systems utilized in this study. One group of four coders underwent training in the use of FSIA-10 while the other group of four coders trained using FSIA-22. During the three week training period the coders met in their respective groups 2 two-hour sessions each week. Thus a total of twelve hours of training in the use of FSIA-10 and FSIA-22 was given. During the training periods the coders practiced using the category systems under each

of the four media forms which were of interest in this study. The initial training session utilized the audiotape medium exclusively with the coders moving into training sessions using videotapes, typescripts and live observation once a basic facility in the use of the systems had been established. The inter-observer reliability for both of the groups of four coders in this study was obtained prior to data collection. The means used to establish inter-observer reliability involved categorization of a fifteen minute classroom session. The fifteen minute episode was selected for the reliability check since the time unit of observation for this study was also fifteen minutes. Flanders reports reliability scores for observers using FSIA-10, determined by a modification of Scott's reliability coefficient, range from .75 to .95 (Flanders, 1965). The coefficients of inter-observer reliability for the four FSIA-10 observers in this study ranged from .85 to .95. Flanders (1970) reports that reliability scores for observers using FSIA-22 range from .70 to .86. The coefficients of inter-observer reliability for the four FSIA-22 observers in this study ranged from .72 to .87.

Immediately following the completion of the reliability training period the observations for the study were made. Each of the sixteen teachers who participated in the study was observed for one twenty minute period. The observations themselves were multifaceted. Two coders were physically present in the classrooms during each observation. One coder was using the FSIA-10 while the other used the FSIA-22 category system to quantify the classroom verbal interaction. Coincident with this an audiotape and a videotape record of the classroom interaction was made. A typescript of the classroom verbal interaction was subsequently prepared from the audiotape record. Thus at the conclusion of each of the sixteen observations the live behavioral record has been quantified using both FSIA-10 and FSIA-22, and the audiotape, videotape and typescript records remained to be quantified.

The collection and quantification of the classroom verbal interaction data for this study occured over a six day period. Figure 2. illustrates the daily order for data collection and analysis for each of the eight coders.

Coder # System		DAY					
		1	2	3	4	5	6
	C_1(FSIA-10) C_2(FSIA-22)	LG_1*	-----	AG_2	VG_3	-----	TG_4
	C_3(FSIA-10) C_4(FSIA-22)	----	AG_1	VG_2	LG_4	TG_3	-----
	C_5(FSIA-10) C_6(FSIA-22)	----	VG_1	LG_3	TG_2	AG_4	-----
	C_7(FSIA-10) C_8(FSIA-22)	----	LG_2*	TG_1	AG_3	VG_4	-----

C = Coder Number
L = Live
A = Audiotape
V = Videotape
T = Typescript
G = Teacher Group Number

* Equipment malfunctions necessitated a second (replacement) observation for one teacher in both group 1 and 2.

Figure 2 - Daily Ordering for Data Collection and Quantification.

The symbols in each cell of Figure 2. identify the medium used in the quantification process and the group of teachers whose classroom interaction was quantified under this medium.form. For example, referring to Figure 2., Coder #3 (C_3) used FSIA-10 to quantify the verbal interaction of Teacher Group #1 (G_1) using the audiotape Medium (A) on day #2. The identification and ordering of the elements of Figure 3. was determined by the Latin Square design employed in this study.

The design for this study required the use of several electronic devices. A mixer was attached to ~~this~~ the tape recorder to enable two microphones with separate volume controls to be used simultaneoulsy in the recording. One microphone was placed in the front of the room facing the teacher while the other was placed on a desk in front of the room facing the students. To insure comparability of the audio components a mixer was inserted in the earphone output of the audiotape recorder. Once modulated through the mixer, the sound was then used as audio input for the videotape recorder. This procedure not only insured the comparability of the sound track on the audio and videotapes, it also enabled the experimenter to use only one set of microphones in the recording of the classroom sessions.

The recording sessions were of twenty minute duration. Of this twenty minutes the first five was a coder orientation period as suggested by Amidon and Flanders (1967). This orientation period was given to enable the coders to acclimate themselves to the lesson and climate of the classroom. Following the orientation period coding commenced and continued for fifteen minutes. To insure synchronization of the coding period a "bleep" was urged to signify the end of the orientation period and the termination of the coding period. The typescript of the verbal interaction was prepared from the audiotape.

Analysis of the Data

The data were analyzed with a 4 X 4 Latin Square repeated measures Anova, the dependent variable being the percentage of verbal behaviors for each of the FSIA-10 and FSIA-22 categories. Recognizing the inherent dependency in the use of column percentages (see p.20), the Alpha level was set at .025. All media effects found to be significant were examined further by the use of Tukey's HSD Test (1953).

RESULTS

Table 1 presents a summary of the F-ratios for the 4 X 4 Latin Square repeated measures analysis of variance with the dependent measures being the actual percentage of behaviors exhibited for each of the FSIA-10 categories. It should be recalled that the variable of interest in this study relates to effect C--Media. Effects A--Teacher Group, and B--Coders, were identified, a priori, as extraneous sources variability which could confound the identification of media effects. The principle of blocking thus was employed in an attempt to extract the variability in the dependent measures which could be attributed to these two sources. The extent to which the blocking procedure was successful is reflected in the significance levels of effects A and B. When the nuisance variables achieve significance they appreciable reduce the residual variance. This reduction in the residual variance increases the efficiency of the Latin Square design relative to other possible designs, and facilitates a more powerful test of effect C--Media.

An examination of the media effect (C) in table 1 for the ten dependent variables shows that there was a significant ($p \leq .025$) media effect for two of the behavioral categories. These were category 4--Teacher Questions, and category 9--Student Talk-Initiated.

Table 2 presents a summary of F-ratios for the analysis of the FSIA-22 categories. Examination of this table shows that there was a significant ($p \leq .025$) media effect for three of the behavioral categories. These were category 4.2--Teacher Questions--Broad, category 9.1--Student Talk-Initiated, and category 10.2--Silence or Confusion-Productive.

Appendix C presents the means and standard deviations of the FSIA-10 and FSIA-22 categories under each of the media forms of interest to this study.

Table 1

SUMMARY OF F-RATIOS FOR FSIA-10 VARIABLES RELATING TO HYPOTHESE ONE

FSIA-10 Category Number	Variables			
	A (Groups)	B (Coders)	C (Media)	(B X C) (Interaction)
1	1.27	2.91	3.13	1.10
2	.34	1.92	.32	.55
3	9.44**	2.62	.91	1.97
4	2.01	.73	4.38*	.37
5	4.38	1.06	.64	2.92*
6	1.24	7.48	.35	1.52
7	.56	5.34*	2.76	.58
8	1.15	2.55	2.35	1.40
9	3.35	12.12**	3.50*	1.48
10	1.11	2.43	1.44	1.14

* $p \leq .025$
** $p \leq .01$

Table 2

SUMMARY OF F-RATIOS FOR FSIA-22 VARIABLES RELATING TO HYPOTHESES TWO

FSIA-22 Category Number	Variables A (Groups)	B (Coders)	C (Media)	(B X C) (Interaction)
1	.15	5.45*	.69	1.03
2.1	1.32	3.36	1.87	1.82
2.2	.14	4.57*	2.89	2.05
3.1	.10	.86	.68	1.80
3.2	.49	2.88	1.11	1.13
3.3	3.34	1.69	1.45	.06
3.4	1.45	15.87**	.20	1.42
4.1	1.14	11.49**	.95	1.32
4.2	3.43	7.23**	5.62**	1.62
5.1	3.12	11.48	2.72	1.60
5.2	2.17	.78	1.17	1.64
5.3	2.02	12.10**	2.54	.22
6.1	.50	11.06**	.56	1.08
6.2	.59	9.61**	1.03	.60
6.3	.67	1.99**	.67	.67
7	1.01	7.26**	.58	1.89
8.1	1.26	21.10**	2.65	3.15*
8.2	2.47	9.90**	.36	1.93
9.1	2.34	15.98**	3.65*	1.99
9.2	2.27	11.07**	3.34	1.79
10.1	.92	5.95**	2.62	3.91*
10.2	1.89	2.69	3.73*	1.99

* $p \leq .025$
** $p \leq .01$

Following the computation of the overall F-tests in the Latin Square analysis of variance for repeated measures for each of the FSIA-10 and FSIA-22 verbal behaviors, a post-hoc analysis was performed using Tukey's (1953) HSD test to examine in greater detail those media effects found to be statistically significant ($p \leq .025$) in this study. The format chosen for reporting the results of the Tukey analyses in this study is the one described by Kirk (1968, p.89). The means are rank ordered and arranged in a two dimensional array. Differences among means are then reported in upper triangular form. This method of tabling the differences facilitates identification of significant differences, as the largest difference will always be in the upper right hand corner and other differences will decrease as the table is read from this corner toward the major diagonal. The HSD test was designed for making all pairwise comparisons among means. Since, however, tabled values for the HSD test at the .025 level of significance are not available, it was necessary to perform the post-hoc analysis using .05 and .01 as significance criterion levels. The effect of this is relatively minor since if the difference between two means exceeds the required HSD value at the .01 level it clearly would also exceed the value at .025. Those differences which are declared signficant at the .05 level, but not the .01 level, must be interpreted with some caution, however, since they may or may not exceed the..025 level used as the error rate in this study.

Tables 3 through 7 present the differences among means for the five behavioral categories identified as having significant media effects.

Table 3

DIFFERENCES AMONG MEANS FOR FSIA-10

CATEGORY 4--TEACHER QUESTIONS

MEDIA	Audiotape	Videotape	Live	Typescript
Audiotape	-----	.54	1.90*	2.11*
Videotape		-----	1.36	1.47
Live			-----	.21
Typescript				-----

* $p \leq .05$ HSD.05 = 1.88
** $p \leq .01$ HSD.01 = 2.34

Table 4

DIFFERENCES AMONG MEANS FOR FSIA-10

CATEGORY 9--STUDENT TALK-INITIATION

MEDIA	Typescript	Videotape	Live	Audiotape
Typescript	-----	.88	2.64	4.08*
Videotape		-----	1.76	3.20
Live			-----	1.44
Audiotape				-----

* $p \leq .05$ HSD.05 = 3.71
** $p \leq .01$ HSD.01 = 4.61

Table 5

DIFFERENCES AMONG MEANS FOR FSIA-22

CATEGORY 4.2--TEACHER QUESTIONS-BROAD

MEDIA	Live	Videotape	Audiotape	Typescript
Live	-----	.12	.79	2.23**
Videotape		-----	.67	2.11**
Audiotape			-----	1.44
Typescript				-----

* $p \leq .05$ HSD .05 = 1.61
** $p \leq .01$ HSD .01 = 1.99

Table 6

DIFFERENCES AMONG MEANS FOR FSIA-22

CATEGORY 9.1--STUDENT TALK-INITIATED

MEDIA	Videotape	Typescript	Audiotape	Live
Videotape	-----	.42	2.20	3.94*
Typescript		-----	1.82	3.56
Audiotape			-----	1.74
Live				-----

* $p \leq .05$ HSD .05 = 2.98
** $p \leq .01$ HSD .01 = 4.90

Table 7

DIFFERENCES AMONG MEANS FOR FSIA-22

CATEGORY 10.2--SILENCE OR CONFUSION-PRODUCTIVE

MEDIA	Typescript	Audiotape	Live	Videotape
Typescript	-----	2.41	2.98*	3.37*
Audiotape		-----	.57	.96
Live			-----	.39
Videotape				-----

* $p \leq .05$ HSD .05 = 2.98
** $p \leq .01$ HSD .01 = 3.71

CONCLUSIONS AND DISCUSSIONS

Media Effect

The comparison of the data which were generated under the four media forms employed in the codification process indicated that for certain specific verbal behaviors the medium used in the observation did exert a significant influence upon the data which were obtained. In the FSIA-10 system Categories 4 (Teacher Questions) and 9 (Student Talk-Initiated) showed a significant media effect. In the FSIA-22 system Categories 4.2 (Teacher Questions-Broad) and 9.1 (Student Talk-Initiated) and 10.2 (Silence or Confusion-Productive) exhibited a significant effect attributable to the medium employed in the codification process. Post-hoc analysis indicated that of the eight significant differences all but two could be attributed to deviations of audiotape, videotape and live observation from typescript. Of those post-hoc comparisons found to be significant at .01 (is clearly beyond the .025 Alpha level for this study) both related to deviations from typescript.

Complexity

In this study two observational category systems--FSIA-10 and FSIA-22--were used to quantify classroom verbal interaction. The fundamental question of the study was whether or not this quantification was affected by the medium employed in the quantification process. A secondary but related question was whether differences that could be attributed to the medium employed in the codification process were more pronounced with increased complexity of the observational category system used. Complexity, as defined in this study, refers to the number of categories an observation system employs. FSIA-22 which has twenty-two categories is considered more complex than FSIA-10 which has only ten categories.

The results of this study do not seem to substantiate the position that as the number of categories increases, making distinctions between the behavioral categories finer and forcing the observer to choose from a greater number of alternatives to decide in what category a given behavior belongs, the media effects become more pronounced. For both FSIA-10 and FSIA-22 the verbal behaviors of Teacher Questions (#4,4.2) and Student Talk-Initiated (#9, 9.1), significant media effects were obtained. In addition FSIA-22 category 10.2, Silence and Confusion-Productive, exhibited a significant media effect. Given the relative purity in terms of numbers of categories found to have a significant media effect and the homogeneity of these categories it appears that, based upon the results of this study, increasing the number of categories from ten to twenty-two does not substantially alter the effects of the medium employed in the coding process.

LIMITATIONS

1) Generalization of the Results

a) It has been assumed that the teachers used in this study, and consequently the verbal behaviors exhibited by these teachers, are a representative sample of teachers from a population of suburban elementary school teachers. The major limitation associated with this assumption is that the teachers used in this study were not randomly selected from a larger population. Since all but one of the teachers approached about being involved in this study volunteered, it seems reasonable to conclude that the sample of teachers, and consequently the verbal behaviors they exhibited, are representative of a larger population of elementary school teachers.

b) It has been assumed that the coders used to quantify the verbal interaction are representative of the population of individuals typically selected to perform the quantification function. In this, as in most reported research studies, university students were trained in the use of the observational systems and performed the actual data collection. The type of individuals selected, the training which they underwent, and the way in which they performed the actual quantification function seems to be congruent with the procedures typically reported in studies of classroom verbal interaction.

2) Category Systems Used

In this study only two category systems, the Flanders ten (FSIA-10) and twenty-two (FSIA-22), were used to quantify classroom verbal interaction. Thus any inferences drawn from this study relate to these two category systems only. This is an extremely severe limitation, particularly as it relates to inferences about the effect of the media with a complex as

opposed to a simple behavioral category system.

3) Non-independent Variables

The data used to test the operational hypotheses were percentage scores obtained from each of the verbal behavior categories identified as dependent variables. Thus there existed a peculiar inter-dependency among the dependent variables. Since percentage scores were used as the unit for analysis once the values of all but one of the dependent variables was known the value of the final variable could be calculated by subtracting the sum of the first N-1 dependent variables from one hundred. This dependency was due to the use of the total number of behaviors as a constant divisor for each category in the derivation of percentage scores. Also, if there is a high concentration of behavior exhibited in one category this gives information about the possible relative size of other categories. This form of dependency exists in all matrix data collection instruments and is a problem which cannot be adequately resolved with our present state of knowledge. Significant findings in one behavioral category will affect the probability of obtaining significant findings in other categories.

A major concern then is whether the significant differences which are found would still exist if the dependency between variables was removed. In order to reduce the possibility of obtaining spurious significant differences due to the interdependency of the dependent variables, a more stringent criterion level than is usually chosen was used. In the study of .025 significance level was selected as the error rate. Only tests of variables significant at or above .025 were considered as support for media effects.

4) Effectiveness of the Equipment Used

The concept being tested, the research design used, and the procedures employed in this study all required the use of several electronic devices.

Thus the results reported and the validity of the study itself depends to a great extent upon the quality of the recordings which were made during the classroom observations. Since it was known that this was the case, extreme care went into the selection and field testing of all equipment prior to the study itself. To a great extent the equipment functioned well. In the judgement of those who actually performed the coding of the classroom verbal interaction, a judgement which is shared by this experimenter, the aural and visual clarity of the classroom observations were more than adequate.

Implications

In spite of the extensive use that has been made of classroom verbal interaction systems to collect data, there is little information in the literature about the effects which the medium employed in the codification process might exert upon the data which are obtained. The present study explored two aspects of media effects. The two areas of media effects studied were whether the medium employed in the codification process affected the data generated, and if these effects became more pronounced with increasing complexity of the behavioral category system used.

There have been differing opinions expressed in the literature regarding which medium form is the "best" way to collect and quantify classroom verbal interaction data. The most common mode for data collection has been live observation. Technological advances have, in the past few years, provided new techniques for obtaining mechanized recordings of classroom interaction. The recent widespread availability, and continually diminishing cost, of audio and videotape recording equipment has resulted in the use of these medium forms for data collection. Proponents of mechanized behavioral recordings assert that the replay and reanalysis capabilities of audio and videotapes facilitate more reliable and valid coding of the classroom

interaction. They further assert that these mechanical recordings enable the researcher to establish the necessary independence between data collection and data codification. Since in the present study few differences were noted between data obtained live and that obtained using audio and videotapes, this position is not supported. With the exception of typescript, a major implication of this study is that for those individuals involved in research using the FSIA-10 or FSIA-22 behavioral category systems, under conditions comparable to those described in this study, other relevant factors such as cost and ease of data collection should be given primary consideration in the selection of a medium form for the collection and quantification of classroom verbal interaction data.

Analysis of classroom verbal interaction with the FSIA-10 and FSIA-22 category systems using typescripts of the interaction does not seem to be appropriate. Data obtained under the typescript medium form was quite different from that obtained under the other three medium forms of interest in this study. When this factor is coupled with the considerable time and cost requirements necessary to transcribe verbatim typescripts of classroom verbal interaction this medium form would appear to have, at best, limited appeal to educational researchers.

Within the framework of this study results indicate no support for the assertion that increased complexity of a behavioral category system results in more pronounced effects attributable to the medium employed in the codification process. This aspect of the study should, in the view of this experimenter, be explored further with other category systems. Intuitively it seems clear that given a continuum of category systems, from very simple to infinitely complex, that at some place on this continuum an area should exist beyond which a live observer cannot function effectively and the replay and reanalysis possibilities offered by audio and videotape recordings becomes essential. An attempt should be made to identify this area, if in

fact it does exist.

It has been asserted (Simon and Boyer, 1967) that the use of a complex system requires a tape recording and/or typescript. In view of the lack of support obtained for the "or" portion of this statement on the complexity issue in this study, and the results which seem to indicate that typescript alone is not comparable to the other methods for quantifying verbal interaction, this position seems to have little foundation. It would appear that future research should be performed to see if analysis of verbal interaction using a typescript in conjunction with either an audio or a videotape record of the interaction provides more valid data.

APPENDICES

APPENDIX A

FSIA-10 CATEGORIES

CATEGORIES FOR

THE FLANDERS SYSTEM OF INTERACTION ANALYSIS

TEACHER TALK	INDIRECT IN-FLUENCE	1.* ACCEPTS FEELING: accepts and clarifies the feeling tone of the students in a non-threatening manner. Feelings may be positive or negative. Predicting or recalling feelings are included. 2.* PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, not at the expense of another individual nodding head or saying, "um hm?" or "go on" are included. 3.* ACCEPTS OR USES IDEAS OF STUDENT: clarifying, building, or developing ideas suggested by a student. As a teacher brings more of his own ideas into play, shift to category five. 4.* ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.
	DIRECT IN-FLUENCE	5.* LECTURING: giving facts or opinions about content or procedure; expressing his own ideas, asking rhetorical questions. 6.* GIVING DIRECTIONS: directions, commands, or orders to which a student is expected to comply. 7.* CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from non-acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
STUDENT TALK		8.* STUDENT TALK-RESPONSE: a student makes a predictable response to teacher. Teacher initiates the contact or solicits student statement and sets limits to what the student says. 9.* STUDENT TALK-INITIATION: talk by students which they initiate. Unpredictable statements in response to teacher. Shift from 8 to 9 as student introduces own ideas. 10.* SILENCE OR CONFUSION: pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

*There is NO scale implied by these numbers. Each number is classificatory, it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.

APPENDIX B

FSIA-22 CATEGORIES

SUB-CATEGORIES FOR

FLANDERS' EXPANDED CATEGORY SYSTEM

Ned. A. Flanders

Level / Category	1	2	3	4
1.	No subscripts for category 1.			
2.	Superficial encouragement like "um hm" and expressions like "right", "good" etc.	Longer praise statements, often explaining praise. Most genuine. Kid really hears it.		
3.	Merely repetition superficial recognition of student's idea.	Student's idea is developed (or used) by teacher as seen by teacher.	Student's idea is developed by teacher in terms of other pupil ideas or compares to other pupil ideas.	Asks questions in levels 2 or 3.
4.	Narrow factual questions, e.g. What? Where? When? and other questions emphasizing recall.	Broad, general open questions which clearly permit a choice of response. Asks opinion.		
5.	Narrow, factual focus. Restricted concepts & purpose. Low level in terms of reasoning.	Not level (1) and not level (3).	Negative and critical, but not "7". Disagrees without comment or explanation..	
6.	Narrow commands to which compliance is expected and can be easily judged.	Explains his directions and how something is to be done.	Provides alternatives, reasons, invites students to help decide what must be done next.	
7.	No subscripts for category 7.			
8.	Student responds by making a statement.	Student asks questions in "tight" format along teacher's lines of thought.		

Cont'd, Sub-Categories for Flanders' Expanded Category System

Level Category	1	2	3	4
9.	Student responses showing freedom of own ideas or simply taking the initiative in terms of talking.	Student asks questions showing freedom of student thought or initiative.		
10.	Non-constructive use of time.	Constructive use of time.		

APPENDIX C

Means and Standard Deviations for FSIA-10 and FSIA-22 Variables

for Four Media Forms

MEANS AND STANDARD DEVIATIONS FOR FSIA-10 VARIABLES FOR FOUR MEDIA FORMS

FSIA-10 Category Numbers	MEDIA FORMS							
	Live		Audiotape		Videotape		Typescript	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
1	.058	.157	.060	.127	.042	.111	.299	.550
2	8.944	3.508	8.346	3.737	8.199	3.977	9.096	3.540
3	2.622	1.478	1.925	2.012	1.889	1.813	2.483	2.020
4	20.61	5.54	18.71	5.56	19.25	5.73	20.82	5.41
5	21.98	12.82	21.51	12.14	22.70	12.02	21.79	11.63
6	4.66	3.03	5.14	3.30	5.05	2.33	5.25	2.86
7	.88	.81	.52	.45	.72	.87	1.11	1.20
8	11.90	5.78	11.36	5.17	14.37	7.10	12.93	4.21
9	14.69	11.68	16.12	14.48	12.92	13.27	12.04	8.35
10	13.66	8.91	16.31	8.54	14.85	8.52	14.18	6.89

MEANS AND STANDARD DEVIATIONS FOR FSIA-22 VARIABLES FOR FOUR MEDIA FORMS

FSIA-22 Category Number	MEDIA FORMS							
	Live		Audiotape		Videotape		Typescript	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
1	0.14	0.27	0.05	0.14	0.08	0.18	0.09	0.20
2.1	3.81	2.17	3.48	2.35	3.48	1.91	4.17	2.07
2.2	0.78	0.71	0.56	0.67	0.68	0.66	1.07	0.98
3.1	5.87	3.40	5.45	3.36	5.19	3.57	5.38	3.60
3.2	1.15	0.79	1.35	1.11	1.09	0.69	1.57	1.24
3.3	0.10	0.23	0.07	0.12	0.15	0.26	0.24	0.34
3.4	0.66	0.74	0.80	0.89	0.66	0.85	0.73	0.73
4.1	16.75	4.58	15.28	5.76	16.11	4.41	16.64	5.53
4.2	1.34	0.88	2.13	2.14	1.59	1.21	3.57	3.44
5.1	20.88	10.30	22.76	11.03	24.08	13.09	21.75	10.04
5.2	1.31	0.83	1.78	1.08	1.28	0.94	2.42	4.41
5.3	1.42	1.14	0.82	0.65	0.80	1.21	0.95	1.08
6.1	3.28	2.23	2.92	1.87	2.87	1.96	3.12	2.17
6.2	0.59	1.21	0.28	0.31	0.24	0.52	0.53	0.81
6.3	0.02	0.07	0.02	0.06	0.00	0.00	0.00	0.00

MEANS AND STANDARD DEVIATIONS FOR FSIA-22 VARIABLES FOR FOUR MEDIA FORMS (continued)

FSIA-22 Category Number	MEDIA FORMS							
	Live		Audiotape		Videotape		Typescript	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
7..	0.56	0.82	0.40	0.59	0.45	0.71	0.58	0.58
8.1	13.96	5.92	14.35	8.06	17.74	8.64	14.94	6.38
8.2	1.32	0.83	1.15	0.81	1.40	1.25	1.35	0.91
9.1	11.18	12.30	10.45	13.51	7.25	7.28	7.62	9.02
9.2	1.18	1.50	0.84	1.20	0.64	0.75	0.84	1.14
10.1	4.82	3.14	6.26	4.87	4.93	3.41	6.53	2.95
10.2	8.91	7.65	8.33	9.05	9.29	7.62	5.92	5.20

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